

# An Innovative Solution to NASA's NEO Impact Threat Mitigation Grand Challenge and Flight Validation Mission Architecture Development

Completed Technology Project (2012 - 2014)



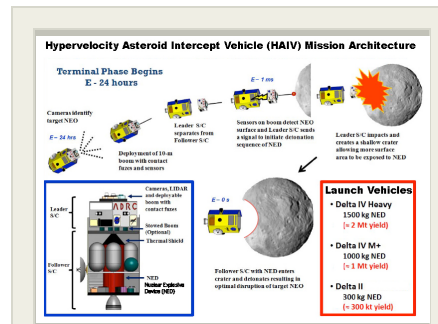
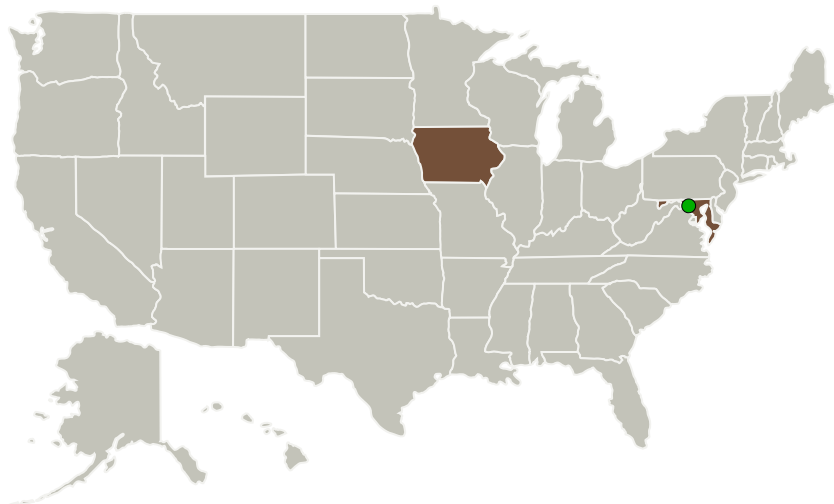
## Project Introduction

A Hypervelocity Asteroid Intercept Vehicle (HAIV) mission architecture, which blends a hypervelocity kinetic impactor with a subsurface nuclear explosion for optimal fragmentation and dispersion of hazardous near-Earth objects (NEOs), has been developed through a 2011 NIAC Phase I study. Despite the uncertainties inherent to the nuclear disruption approach, disruption can become an effective strategy if most fragments disperse at speeds in excess of the escape velocity of an asteroid so that a very small number of fragments impacts the Earth. Thus, the proposed HAIV system will become essential for reliably mitigating the most probable impact threat: NEOs with warning times shorter than 10 years. It offers a potential breakthrough or great leap in mission capabilities for mitigating the impact threat of NEOs. The proposed Phase II study further develops the HAIV-based mission architecture and explores its potential infusion options within NASA and beyond.

## Anticipated Benefits

This technology could be a key asset that simultaneously benefits planetary defense, fundamental solar system science, and space exploration.

## Primary U.S. Work Locations and Key Partners



Concept Diagram

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Organizations Performing Work	Role	Type	Location
Iowa State University	Lead Organization	Academia	Ames, Iowa
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Iowa	Maryland

## Project Transitions

**September 2012:** Project Start

**September 2014:** Closed out

**Closeout Summary:** This final technical report describes the results of a NASA Innovative Advanced Concept (NIAC) Phase 2 study entitled An Innovative Solution to NASA's NEO Impact Threat Mitigation Grand Challenge and Flight Validation Mission Architecture Development. This NIAC Phase 2 study was conducted at the Asteroid Deflection Research Center (ADRC) of Iowa State University in 2012-2014. The study objective was to develop an innovative yet practically implementable solution to the most probable impact threat of an asteroid or comet with short warning time (<5 years). The technical materials contained in this final report are based on numerous technical papers, which have been previously published by the project team of the NIAC Phase 1 and 2 studies during the past three years. Those technical papers as well as a NIAC Phase 2 Executive Summary report can be downloaded from the ADRC website ([www.adrc.iastate.edu](http://www.adrc.iastate.edu)).

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Iowa State University

### Responsible Program:

NASA Innovative Advanced Concepts

## Project Management

### Program Director:

Jason E Derleth

### Program Manager:

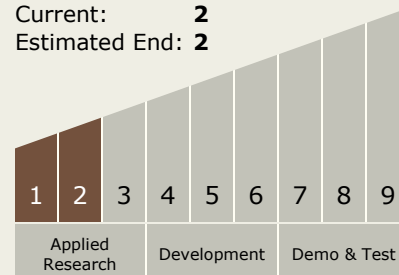
Eric A Eberly

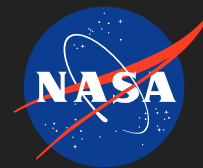
### Principal Investigator:

Bong Wie

## Technology Maturity (TRL)

Start: **1**  
Current: **2**  
Estimated End: **2**



[illegible]

Concept Diagram  
(<https://techport.nasa.gov/image/102320>)

**Primary:**

- TX01 Propulsion Systems
  - └ TX01.4 Advanced Propulsion
    - └ TX01.4.4 Other Advanced Propulsion Approaches

## Others Inside the Solar System